

#707

IRAS

Surface Brightness Maps of Large Optical Galaxies
83-004A-01f

Bright Point Source-Removed ZOHF1
83-004A-01n

2 JY REDSHIFT SURVEY
83-004A-01p

REQ. AGENT

CMW

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MEV

IRAS

**SURFACE BRIGHTNESS MAPS OF
LARGE OPTICAL GALAXIES**

83-004A-01f

This data set catalog contains 1 magnetic tape. One IRAS tape. This tape is 6250 BPI, Binary, 9 track, contains 664 files, and created on the IBM computer. The following list the D#'s, C#'s, and NSSDC ID#'s of the tape.

| D# | C# | TIME SPAN | NSSDC ID# |
|-----------|-----------|------------------|------------------|
| ----- | ----- | ----- | ----- |
| D-82892 | C-28213 | NOT AVAILABLE | 83-004A-01f |

I. INTRODUCTION

"A CATALOG OF IRAS OBSERVATIONS OF LARGE OPTICAL GALAXIES" (Rice *et al.* 1988, Ap. J. Suppl., in press; hereafter the Large Galaxy Catalog or the LGC) reports the observations of 85 galaxies listed in RC2 with apparent blue light isophotal diameters (D_{25}) greater than 8'. The LGC sample is listed in Table 1. The IRAS 12, 25, 60, and 100 μm surface brightness maps of these galaxies, written to tape in FITS format, are provided to the astronomical community as an IPAC product. This IPAC Report is a user's guide to the tape product.

Chapter II presents a brief description of the data processing to produce the maps and the techniques used to obtain "total" flux densities of the sample galaxies. A detailed discussion can be found in the Large Galaxy Catalog and, of the data processing, in the IRAS Pointed Observations Guide (Young *et al.* 1985, IPAC Report; hereafter the POG). The tape product is described in Chapter III. An atlas of contour maps of the galaxy images presented in the appendix is described in Chapter IV.

II. DATA PROCESSING AND REDUCTION

Surface brightness (INTN mode) and point source filtered (FLUX mode) spatial maps of the galaxy fields were produced from coadded multi-scan leg Pointed Observation data, described by Neugebauer *et al.* (1984, Ap. J. Ltrs.) and in the POG, or, if these did not exist, from coadded single-scan leg all-sky survey data. Total intensity was preserved in the unfiltered surface brightness maps permitting a measurement of the "total" flux density of galaxies observed as extended sources.

The attributes of the surface brightness maps are listed in Table 2. The column entries are:

Column (1). Galaxy LGC Number. This is also the atlas figure number of the map contour plots displayed in the appendix.

Column (2). Galaxy Name.

Column (3). Observation Type. Denotes the type of data coadded to produce the map—Pointed Observation (PO) or all-sky Survey Scan (SS).

Column (4). IRAS Source Extent Code. Denotes the observed extent of the galaxy (E—extended, P—point source) and the type of map used to obtain total flux densities, as described in the LGC.

Columns (5)–(6). Map Center. Equatorial coordinates (equinox 1950) of the map center.

Column (7). Position Angle. The position angle, east of north, of the coadded map. Although in some cases this angle is coincident with the scanning angle (the "in-scan" direction) of the component observations, particularly for PO maps, in general this is not true. Most of the coadded SS maps were constructed setting $PA = 0$, that is, north to the top (along the map +Y-axis) and west to the right (along the map +Z-axis), without regard for the scanning angle of the component scans. And, some of the coadded PO and SS maps were constructed from component observations with different scanning directions. The dominant scanning

direction of the component scans can be estimated using the shape of point-like sources in the map.

Columns (8)-(9). Map Size. The Z- and Y-dimensions of the map in degrees.

Columns (10)-(11). Pixel Size. The z- and y-dimensions of the pixels of the 12 μm map in arc minutes.

In general, SS maps have square pixels of $0'.25 \times 0'.25$ for the 12 and 25 μm maps, $0'.5 \times 0'.5$ for the 60 μm map, and $1' \times 1'$ for the 100 μm map. The SS maps of the SMC and LMC have been smoothed to the resolution of the 100 μm band (see Appendix B) and have $1' \times 1'$ pixels for each band. For most PO maps the pixels are ($z \times y$) $0'.6 \times 0'.25$, $0'.6 \times 0'.25$, $0'.6 \times 0'.5$, and $0'.6 \times 1'$ for the four wavelength maps, respectively. (The pixel size for each image is encoded in the image FITS header. See Appendix A.)

Note that the pixel size of the wavelength maps *does not* correspond to the IRAS resolution. The in-scan resolution of the IRAS beam is approximately $0'.8$ for the 12 and 25 μm beam, $1'.5$ for the 60 μm beam, and $3'$ for the 100 μm beam. The cross-scan resolution is approximately $5'$ at each wavelength.

Columns (12)-(15). Map Noise. The median noise level ($1-\sigma$) in units of mJy/arcmin 2 of the 12, 25, 60, and 100 μm wavelength surface brightness maps.

The local background of the galaxies fields due to diffuse zodiacal and Galactic emission was removed using the techniques described in the Large Galaxy Catalog. Briefly, a first estimate of the background emission, taken to be the median pixel intensity value of the map, was subtracted from each pixel. The residual field gradient of the emission was then removed using one of two techniques. In the first the medians of the intensity value differences of paired pixels in adjacent columns and rows across the maps were calculated, adjusted to zero mean, and removed. The second technique, which produced better results in fields with complicated backgrounds, removed a surface computed from least-squares fits to the low level intensity values of pixel columns of the maps. For most maps, the remaining background was flat with variations within ~ 3 times the noise level of the map. A few of the galaxies were embedded in extensive Galactic "cirrus" emission (Low *et al.* 1984, Ap. J. Ltrs) which resulted in poor background removal. For these, a second order estimate of the local background was obtained by calculating the mean intensity within an outlying annular aperture centered on the galaxy optical position.

The surface brightness maps were used to measure total flux densities of the galaxies determined as extended IRAS sources based on their in-scan profiles (see the Large Galaxy Catalog). Numerical apertures centered on the galaxy optical positions were used to sum the map pixel intensity values brighter than 25 mJy/arcmin 2 ($\sim 3 - 6\sigma$). For the galaxies observed as unresolved sources, the total flux densities were obtained from point source filtered maps. Table 3 lists the total flux densities reported in the Large Galaxy Catalog.

III. THE TAPE PRODUCT

The surface brightness maps have been written to tape in FITS format. There are 83 sets of maps (NGC 205 and M31 are in one field as are M81 and M82), each set consisting of an image and noise map for

each of the four IRAS wavelength bands. All of the maps fit on one 6250 bpi tape. Table 4 lists the tape file number of the images (8 for each object) and the IPAC grid identification number of the maps.

The tape format is that described in the POG (Appendix A.2) and presented in Appendix A. Minor revisions are described below.

(1). The nonstandard FITS keyword BIAS gives the estimated baseline of the unflattened image taken to be the median pixel intensity value of the map. This value was subtracted from each map pixel.

(2) For maps constructed from all-sky survey scans the observer ID field of the keyword OBJECT is SS.

Note that the map median noise, the number of component observations, and the map orientation angle (GRID TWIST) are given in comment fields. The position angle of the maps is listed in Table 2.

In Appendix B a technique for smoothing the maps to a common resolution is presented.

IV. ATLAS OF MAP CONTOUR PLOTS

Contour plots of the surface brightness maps scaled by the map median noise are displayed in the accompanying atlas (Appendix C). While the plots presented in the Large Galaxy Catalog display selected contour levels of a sub-region of the map centered on the galaxy, the plots presented here display the entire map using a common set of contour levels. For each map, the dashed contours levels are at 15-, 9-, and 6- σ below the residual background level, and the solid contours are at 3-, 6-, and 10- σ with brighter contours scaled logarithmically by 2 from 10- σ (i.e. 20-, 40-, 80- σ , etc.).

APPENDIX A: FORMAT OF FITS TAPES

The magnetic tape form of the Large Galaxy Catalog contains the coadded map data arrays of pixels recorded in FITS format. Each map is represented by eight files on the tape— $12 \mu\text{m}$ image array, $12 \mu\text{m}$ noise array, $25 \mu\text{m}$ image array, $25 \mu\text{m}$ noise array, $60 \mu\text{m}$ image array, $60 \mu\text{m}$ noise array, $100 \mu\text{m}$ image array, and $100 \mu\text{m}$ noise array. The first two records of each file contain the FITS header, then the first data array begins in the third record as a stream of pixel values divided into 2880 byte records without regard to line length. The final record is padded to 2880 bytes with zeros. Four byte integers are used for the image and noise data.

Standard FITS keywords are used where possible. Explanations and nonstandard keywords are given below.

BZERO — This parameter is set to zero in all maps. The baseline, taken to be the median of the intensity values of the unflattened map, has been removed. The value of the baseline is given in the nonstandard keyword **BIAS**.

BUNIT — The maps have units of Jy/Sr.

CDELT1, CDELT2 — The x- and y-cell dimensions in degrees.

CROTA2 — The map twist angle measured from the +Y axis to the north (i.e. minus the conventional Position Angle).

DSKYGRID — A nonstandard keyword which gives the IPAC grid identification number of the map.

OBJECT — Identifies the type of observations coadded to produce the map. SS denotes all-sky survey scans.

Table A.1 displays a sample FITS header.

TABLE A.1 Sample FITS Header

SIMPLE = T / STANDARD FITS FORMAT
 BITPIX = 32 / 4 BYTE TWO'S-COMPL INTEGERS
 NAXIS = 3 / NUMBER OF AXES
 NAXIS1 = 240 / NZ = Z (CROSS-SCAN) GRID DIMENSION
 NAXIS2 = 240 / NY = Y (IN-SCAN) GRID DIMENSION
 NAXIS3 = 1 / # WAVELENGTHS
 BSCALE = 7.083475E+04 / TRUE=TAPE*BSCALE + BZERO
 BZERO = 0.0
 BUNIT = 'JY/SR' / INTN
 BLANK = -200000000 / TAPE VALUE FOR EMPTY CELL
 CRVAL1 = 2.883300E+00 / RA AT ORIGIN (DEGREES)
 CRPIX1 = 121. / Z-AXIS ORIGIN (CELL) = (NZ/2)+1
 CTYPE1 = 'RA---SIN' / DECREASES IN VALUE AS SAMPLE INDEX
 COMMENT INCREASES (ORTHOGRAPHIC PROJECTION)
 CDELT1 = -4.166666E-03 / Z-GRID CELL WIDTH (DEGREES)
 CROTA1 = 0.0 / TWIST ANGLE UNDEFINED FOR Z-AXIS
 CRVAL2 = -2.345779E+01 / DEC AT ORIGIN (DEGREES)
 CRPIX2 = 121. / Y-AXIS ORIGIN (CELL)= (NY/2)+1
 CTYPE2 = 'DEC--SIN' / INCREASES IN VALUE AS LINE INDEX
 COMMENT INCREASES (ORTHOGRAPHIC PROJECTION)
 CDELT2 = 4.166666E-03 / Y-GRID CELL WIDTH (DEGREES)
 CROTA2 = 0.0 / ROTATES +NAXIS2 INTO +DEC AXIS (ANGLE
 COMMENT MEASURED POSITIVE CCW FROM +NAXIS2 TO
 COMMENT +DEC) (DEGREES)
 CRVAL3 = 1.2E-05 / WAVELENGTH IN METERS
 CRPIX3 = 1.
 CTYPE3 = 'LAMBDA'
 CDELT3 = 0.
 CROTA3 = 0.
 DATA MAX = 2.550051E+06 / JY/SR (TRUE VALUE)
 DATA MIN = -4.958432E+05 / JY/SR (TRUE VALUE)
 BIAS = 2.343766E+07 / BIAS LEVEL (GRID REF) IN JY/SR
 EPOCH = 1950. / EME50
 DATE-OBS= '0/ 0/83' / DATE OF OBSERVATION (DD/MM/YY)
 DATE = '23/ 2/88' / DATE THIS TAPE WRITTEN (DD/MM/YY)
 ORIGIN = 'JPL-IRAS' / INSTITUTION
 TELESCOP= 'IRAS'
 INSTRUME= 'DEEPSKY'
 COMMENT DSSID = SS02
 DSKYGRID= 4472. / DEEPSKY GRID NO.
 DATE-CR = '53331321' / DSGAD O/P FILE CREATION DATE(YDDDHHMM
 COMMENT EST.MEDIAN NOISE= 1.416696E+05 JY/SR
 HISTORY CALFAC USED = 7.200E+12
 COMMENT GRID TWIST = 1.800000E+02 (DEG) MEAS
 COMMENT URED FROM SOUTH TO +Y, CW IS POSITIVE
 COMMENT GAIN NORM. USED = 9.300000E-01
 COMMENT MFILT = 1
 COMMENT KFILT = 0
 OBJECT = 'SS 557' / OBSERVER I.D.+IGO'S A.O.NO.
 COMMENT IGO'S REP. SEQ. NO. = 0
 OBSERVER= '1928A1' / DS01,2 SIS: C1 FIELD
 COMMENT OBJ.NAME NO. (C2) FIELD = 5
 COMMENT DS01,2 SIS: D(1-4) = 2 16 58 3
 COMMENT DS01,2 SIS: E(1-3) = 32 31 50
 COMMENT DS01,2 SIS: PROG = SURMAP
 COMMENT # DEEP SKY GRID COMPONENTS = 19
 COMMENT GCOMPS: 2766 2768 2770 2772 2774
 COMMENT GCOMPS: 2776 2778 2780 2782 2784
 COMMENT GCOMPS: 2786 2788 2790 2792 2794
 COMMENT GCOMPS: 2796 2798 2800 2802
 COMMENT REFERENCES:
 COMMENT IRAS SDAS SOFTWARE INTERFACE SPECIFICATION(SIS) #623-94/NO. DS01
 COMMENT IRAS SDAS SOFTWARE INTERFACE SPECIFICATION(SIS) #623-94/NO. DS02
 COMMENT THE GUIDE TO IRAS POINTED OBSERVATIONS, NOVEMBER 1985
 COMMENT IRAS/SDAS SUBSYSTEM DESIGN SPEC., DEEP SKY SURVEY SUBSYSTEM (#623-75)
 COMMENT ASTRON. ASTROPHYS. SUPPL. SER. 44, (1981) 363-370 (RE:FITS)
 END

APPENDIX B: SMOOTHING IMAGES TO A COMMON RESOLUTION

The in-scan resolution (FWHM) of the coadded IRAS images is approximately 0'8 for the 12 and 25 μm maps, 1'5 for the 60 μm map, and 3' for the 100 μm map. The cross-scan resolution is approximately 5' for each wavelength map. The maps can be smoothed to a common resolution using the FORTRAN subroutine listed below. To smooth the 12, 25, and 60 μm maps to the resolution of the 100 μm map apply the algorithm twice along the in-scan (or Y-direction) of the 12 and 25 μm data and once for the 60 μm data. This routine or, for PO maps with rectangular pixels, linear interpolation can be used to produce maps with common size cross-scan (or Z-direction) pixels. Note that empty map pixels should not be used in the convolution or interpolation.

As discussed in §II, many of the maps are not aligned along the IRAS scanning direction or are composed of scans with a range of scanning angles. The smoothing for these maps is approximate and the user should exercise caution when ratioing the smoothed maps.

FORTRAN ROUTINE FOR SMOOTHING MAPS

SUBROUTINE SMOOTH(FLX,SIG,ANSFLX,ANSSIG,EMPTY)

```
C
C      FLX = VECTOR OF IMAGE MAP COLUMN (ROW) PIXEL VALUES;
C      ELEVEN ELEMENT VECTOR IS CENTERED ON EVERY OTHER PIXEL (FLX(6))
C      WITH FIVE ADJACENT COLUMN (ROW) PIXELS ON EITHER SIDE
C      SIG = CORRESPONDING VECTOR OF NOISE MAP COLUMN (OR ROW)
C      PIXEL VALUES. SIG(I) .LE. 0.0 FOR EMPTY FLX(I) CELL.
C      ANSFLX = CONVOLVED SIGNAL MAP PIXEL VALUE
C      ANSSIG = CONVOLVED NOISE MAP PIXEL VALUE
C      FILTER = CONVOLUTION FILTER
C      EMPTY = IMAGE VALUE OF EMPTY CELL
C
REAL*4 FLX(11),SIG(11),FILTER(11)
DATA FILTER/ 0.057, 0.155, 0.397, 0.740, 0.946, 1.000, .946, 0.740, 0.397, 0.155, 0.057/
C
CNORMF = 0.0
CNORMS = 0.0
ANSFLX = EMPTY
IF(SIG(6).LE.0.0) RETURN
ANSFLX = 0.0
```

```
ANSSIG = 0.0
DO 1 I=1,11
IF(SIG(I).LE.0.0) GO TO 1
ANSFLX = ANSFLX + FILTER(I) * FLX(I)
ANSSIG = ANSSIG + (FILTER(I) * FILTER(I)) * (SIG(I) * SIG(I))
CNORMF = CNORMF + FILTER(I)
CNORMS = CNORMS + (FILTER(I) * FILTER(I))
1 CONTINUE
ANSFLX = ANSFLX / CNORMF
ANSSIG = SQRT(ANSIG / CNORMS)
RETURN
END
```

IRAS Surface Brightness Maps
of Large Optical Galaxies
LIST OF GLS CUTS

) INPUT PARAMETERS ARE: AS SR=1=1

| | | | | | |
|---|---|--|---|-------------------|--|
| TAPE NO. | 1 | FILE NO. | 1 | B - 38443 - 000 A | |
| RECORD | 1 | LENGTH | 288CJ | 83-004A-01F | |
| SIMPLE | 32 | NAXIS1 | = 240 | | |
| BLOCKED | = | NAXIS2 | = T | | |
| 7.083475E+04 | / TRUE=TAPE*BSCALE | / TAPE RECORDS MAY BE BLOCKED | BSCALE = 0.0 | | |
| CROVAL1 | = BLANK | BUNIT = JY/SR | / TAPE VALUE FCR EMPTY CELL | | |
| | = 2.883300E+03 | / RA AT ORIGIN (DEGREES) | CRPIX1 = 0.0 / INTN | | |
| 121. | / Z-AXIS ORIGIN (CELL) = (N/2)+1 | CTYPE1 = *RA---SIN* | INCREASES | | |
| S (ORTHOGONAL PROJECTION) CDELT1 | = 0.0 | / DEC AT ORIGIN (DEGREES) | -4.016666E-03 / Z-GRID CELL WIDTH (DEGREES) | | |
| CROVAL2 | = -2.345779E+01 | / TWIST ANGLE UNDEFINED FOR Z-AXIS | CRVAL2 | | |
| 121. | / Y-AXIS ORIGIN (CELL) = (N/2)+1 | CTYPE2 = *DEC--SIN* | INCRAESES (CRTGRAPH) | | |
| REASES IN VALUE AS LINE INDEX C PROJECTION) CDELT2 | = t.0 | / ROTATES +NAXIS2 INTO +DEC AXIS (ANGLE COMMENT) | CRO | | |
| TZ2 | = | / NAXIS2 FROM +NAXIS2 TO COMMENT | +DEC (DEGREES) | | |
| +DEC) (DEGREES) CRVAL3 | = | 1.02E-05 / WAVELENGTH IN METRE | | | |
| CTYPE3 | = *LAMBDA | CRPIX3 = 1. | CDELT3 = | | |
| VALUE) | DATAMIN = 2.343766E+07 | CRCTA3 = 0. | CRCTA3 = U. | | |
| BIAS | / DATE-CR = 1954. / EMES | DATA MAX = -4.958432E+05 | 2.056051E+06 / JY/SR (TRUE | | |
| | / DATE OF OBSERVATION (DD/MM/YY) | / BIAS LEVEL (GRID REF) IN JY/SR | / JY/SR (TRUE VALUE) | | |
| TAPE WRITTEN (DD/MM/YY) | DATE = 23/ 2/88, | DATE-CBS= , | E/ E/83. | | |
| TELESCOP= *IRAS | | INSTITUTION | DATE THIS | | |
| DEEPSKY | | | INSTRUME= | | |
| GRID NO. | DSSID = SS02 | DSKYGRID= | 4472. / DEEPSK | | |
| ATE(YDDHHMM)COMMENT | DATE-CR = 53331321, | EST.MEDIAN NOISE= | / DSGAD O/P FILE CREATION D | | |
| | / OBSERVER I.D.+IGO'S A.O.NO. | 7.200E+12 | COMMENT | | |
| ED FROM SOUTH TO +Y, CW IS POSITIVE.COMMENT | GRID TWIST = 1.800000E+02 (DEG) | MEAS-COMMENT | COMMENT | | |
| 3000DE-01 COMMENT | KFILT = | Mfilt = 1 | GAIN NORM. USED = 9 | | |
| COMMENT | / OBSERVER I.D.+IGO'S A.O.NO. | COMMENT | OBJECT = *SS 557 CO | | |
| IGO'S REP. SEG. NO. = t | COMMENT | | | | |
| FIELD COMMENT | DS01,2 SIS: DS01,2 SIS: DS01,2 SIS: DS01,2 SIS: | C1 F1 | C1 F1 | | |
| ID COMPONENTS = 19 COMMENT | DS01,2 SIS: DS01,2 SIS: DS01,2 SIS: DS01,2 SIS: | COMMENT | COMMENT | | |
| 2774 COMMENT | GCOMP: | 2776 2778 2780 2792 | GCOMP: | | |
| | COMMENT | 2800 2802 2754 COMMENT | 2784 COMMENT | | |
| GCOMP: | 2796 2798 2800 2802 | COMMENT | COMMENT | | |
| \$01 COMMENT IRAS SDAS SOFTWARE INTERFACE SPECIFICATION(SIS) #623-94/NO. D | IRAS SDAS SOFTWARE INTERFACE SPECIFICATION(SIS) #623-94/NO. | COMMENT | COMMENT | | |
| THE GUIDE TO IRAS POINTED OBSERVATIONS, NOVEMBER 1985 | SDAS SUBSYSTEM | COMMENT | COMMENT | | |
| DESIGN SPEC. DEEP SKY SURVEY SUBSYSTEM (#623-75), COMMENT ASTRON. ASTROPHYS. SUPPL. SER. 44, (198 | END | | | | |
| 1) 363-370(REFITS) | | | | | |

```

***** JOB DONE.

$EXE TFLIST BS

INPUT PARAMETERS ARE: AS SR=1 1 1 664
TAPE NO. 1 FILE NO. 664
RECORD 1 LENGTH 14400
SIMPLE = 32 NAXIS1 = 30 NAXIS2 = 30
BLOCKED = T / TAPE RECORDS MAY BE BLOCKED BSCALE =
6.137311E+04 / TRUE=TAPE*BSCALE + BZERO BZERO = 0.0
STICAL WEIGHT1 CRVAL1 = 3.598494E+12 / JY/SR BUNIT = 'JY/SR' / NOIS (STATI
BLANK = 3.598494E+12 / RA AT ORIGIN (DEGREES) CRPIX1 =
16. / Z-AXIS ORIGIN (CELL) = (NZ/2)+1 TYPE1 = 'RA---SIN'.
/ DECREASE IN VALUE AS SAMPLE INDEX COMMENT AS SAMPLE INDEX COMMENT
ES (CARTOGRAPHIC PROJECTION) CDELT1 = -1.666667E-02 / Z-GRID CELL WIDTH (DEGREES)
CROTA1 = 9.0 / TWIST ANGLE UNDEFINED FOR Z-AXIS CRVAL2 =
-1.574330E+01 / DEC AT ORIGIN (DEGREES) CRPIX2 =
31. / Y-AXIS ORIGIN (CELL) = (NY/2)+1 TYPE2 = 'DEC--SIN'. / INC
REASES IN VALUE AS LINE INDEX COMMENT AS LINE INDEX
IC PROJECTION) CDELT2 = 1.666667E-02 / Y-GRID CELL WIDTH (DEGREES)
IA2 = -1.555800E+02 / ROTATES +NAXIS2 INTO +DEC AXIS CRO
MEASURED POSITIVE CCW FROM +NAXIS2 TO COMMENT
CROVAL3 = 1.0E-04 / WAVELENGTH IN METER
+ DEC) (DEGREES)

```


REQ. AGENT

CMW

ACQ. AGENT

MEV

IRAS

BRIGHT POINT SOURCE-REMOVED

ZOHF1

83-004A-01n

This data set catalog contains 1 magnetic tape. One IRAS tape. This tape is 6250 BPI, ASCII, 9 track, contains 31 files, and created on the IBM computer. The following list the D#'s, C#'s, time span and NSSDC ID#'s of the tape.

| D# | C# | TIME SPAN | NSSDC ID# |
|---------|---------|---------------------|-------------|
| D-85848 | C-29050 | 01/26/83 - 11/22/83 | 83-004A-01n |



CALIFORNIA INSTITUTE OF TECHNOLOGY

Pasadena, California 91125

December 12, 1991
Refer to: 701-CO/dlm

Michael van Steenberg
NSSDC
NASA Goddard Space Flight Center
Org. 933.0
Greenbelt, MD 20771

Dear Dr. van Steenberg:

This letter documents the release of the Version 1.0 Bright Point Source-Removed Zodiacal History File. This new product was produced at the request of astronomers interested in studying the interstellar background without the effects of point sources. The file has the same structure and resolution as the standard ZOHF, with $1/2^\circ \times 1/2^\circ$ pixels.

To produce the file, a set of bright point sources from the IRAS Point Source Catalog (PSC) was identified. Only PSC sources with absolute ecliptic latitude greater than 5° and the flux thresholds given in Table 1, below, were used. A source can appear in and, therefore, be removed from more than one wavelength band. For each of these sources, the compressed detector data (CMDD) samples that fall within a $10'$ radius of the PSC position are left out of the intensity average.

Table 1
Summary of $|\beta| > 5^\circ$ PSC sources identified for
removal in the Bright Point Source-Removed ZOHF

| Wavelength μm | Flux | |
|-----------------------------|-----------------|----------------|
| | Threshold Jy | No. of Sources |
| 12 | 15 | 2235 |
| 25 | 20 | 942 |
| 60 | 20 | 713 |
| 100 | 20 | 6698 |

At 12 and 25 μm , the source tails were removed from the ZOHF pixel averages in the following way. After encountering a PSC source, the CMDD samples that fall within $5'$ (half the radius used for source removal) of the cross-scan position of the source are removed in-scan, pixel by pixel, until the difference between the ZOHF pixel computed with and without the tail drops below the flux threshold (given in Table 1) for the band

or until the tail length exceeds a maximum of 240 in-scan CMDD samples. The maximum tail length is based on the tail observed in the CMDD data for IRC 10216.

When less than half the detectors within a band are used for the ZOHF average, the intensity for that band was set to -999.

Gradients in large scale emission can cause artifacts in this product. For example, when a gradient exists, the source tail removal algorithm can remove the maximum tail from a source that actually has a small tail. Gradients also make possible the situation where a pixel with samples removed has a higher intensity average than the same pixel with no samples removed. This may be seen in standard ZOHF to Bright Point Source-Removed ZOHF comparisons.

Sincerely,

Carol A. Oken

Carol A. Oken

| cc (w/tapes): | IPAC Library | (w/o tapes): | IPAC |
|---------------|-------------------|--------------|---------------|
| | D. Giaretta | | S. Dermott |
| | D. Goorvitch | | C. Heiles |
| | F. Gillett | | G. Neugebauer |
| | H. Habing | | P. Nicholson |
| | M. Hauser | | M. Sykes |
| | J. Houck | | R. Walker |
| | F. Low | | M. Werner |
| | M. Rowan-Robinson | | E. Young |
| | T. Soifer | | |

REQ. AGENT

CMW

ACQ. AGENT

MEV

IRAS

IR TELESCOPE

2 JY REDSHIFT SURVEY

83-004A-01p

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| D# | C# | NSSDC ID# |
|------------------|------------------|----------------------|
| ----- D-86023 | ----- C-29229 | ----- 83-004A-01p |

An Explanation of the IRAS 2Jy Redshift Survey Data File

This is an explanation of a pre-publication version of the redshift survey of Strauss, Davis, Yahil and Huchra; the data set is described in full in ApJ 361, 49 (1990). The data are included in a paper submitted to the Astrophysical Journal Supplement. The survey contains 5014 objects selected from the IRAS database according to the criteria listed in that paper; briefly:

```
F60 > 1.936 Jy;  
F60^2 > F12 f25;  
|b| < 5;  
high source density flag at 60 microns not raised.
```

Thus, the file consists of both galaxies and Galaxian contaminants; this is explained below. The subset of the galaxies only (2658 sources) is a separate file.

The file may be read with the following read statement:

```
read (1,'(2i2,f4.1,a1,3i2,x,4i4,x,2i1,3a1,4i1,a12,f5.2,x,i5,i3,  
& a4,a5,x,i6,f5.2,a6,x,a20,4i4)')  
& hour, raminute, rasecond, decsign, decdegree, decminute,  
& decsecond, nf12, nf25, nf60, nf100, idtype, extendflag, CC,  
& varflag, statusflag, fq12, fq25, fq60, fq100, mag, vel, velerr,  
& source, ttype, unumber, bt, spectrum, comments, pf12, pf25, pf60  
& pf100
```

The coordinates for all objects that appear in the IRAS PSC, Version 2, are from that source, and are given as B1950.0; there are also a few very large galaxies whose fluxes and coordinates are taken from the Large Optical Galaxy Catalog (Rice et al. 1988, ApJS, 68, 91).

The IRAS fluxes are coded in a compact logarithmic form:

The 12 micron flux is related to the integer nF12 by

F12 = 10.^(nF12/1000 - 1.); similarly for the other fluxes. The fluxes are taken from the PSC, unless:

1. The object is extended at 60 microns (see extendflag below);
2. The object is variable (see varflag below);
3. The object is of moderate flux quality at 60 microns (see Fq60 below).

In these cases, we have obtained one-dimensional addscan's of the data and used the zero-crossing flux from the median scan's in all four bands, as supplied by SCANPI.

Those sources flagged as extended in Rice et al. have fluxes from that source. The idtype is taken directly from the PSC; a description may be found in the explanatory supplement.

The extendflag indicates whether or not an object is flagged as extended (SES(2) flag) in the psc.

| | |
|----------------|------------------------------------|
| extendflag = 0 | Not extended |
| 1 | Extended at 12 microns |
| 2 | Extended at 25 microns |
| 3 | Extended at 12 and 25 microns |
| 4 | Extended at 60 microns |
| 5 | Extended at 12 and 60 microns |
| 6 | Extended at 25 and 60 microns |
| 7 | Extended at 12, 25, and 60 microns |
| 8 | Extended in Rice et al |

The correlation coefficient is taken from the PSC and represents the best correlation coefficient between a hours-confirmed scan and the point source template at 60 microns in the Point Source Data Base; see the Explanatory Supplement for details. A means 99% or better correlation, B is between 98 and 99% and so on.

The varflag is a measure of variability in 12 and 25 microns.

| | |
|---|--------------------------------------|
| n | No measure of variability available. |
| 0 | No variability measured. |

N Variability between 1 and 10%.
1 Variability between 10 and 20%
and so on.

The statusflag indicates the identification of the source, and, if it is a galaxy, the source of the redshift:

Galaxies: O,H,Z,F,B,D. The distinction between these is uninteresting, although Z indicates a source drawn from John Huchra's private version of ZCAT.
L: Local Group galaxy. This is given a separate flag.

Non-galaxies:

M: HII region in external galaxy.

S: Star

S: Emission line star

C: Cirrus or dark cloud

P: Planetary nebula

R: Reflection Nebula

? or E: Unidentified field.

These labels are by no means complete; we observed only a fraction of these sources at the telescope. See Strauss et al. 1990 and Yahil et al. 1991 (ApJ, 372, 380) for a discussion of our estimate of the number of sources flagged as cirrus that are indeed galaxies.

The flux qualities are taken from the PSC; one number between one and three is given for each band:

- 1: Not detected
- 2: Moderate flux quality
- 3: Good flux quality

If the flux given is from the PSC (as opposed to ADDSCAN), the flux listed in a band with flux quality 1 will be an upper limit.

Optical identification is from a matching of the combined UGC, Zwicky, and NGC catalogs, and is not complete. We will improve this in the near future. Occasionally, these columns will contain obvious junk, which should be ignored.

Magnitudes are from the same source, and again are not complete.

Redshifts and errors are either as quoted in the literature, or measured by us. All are heliocentric.

source is a four-digit number that codes the redshift source from ZCAT.
ttype is the type of the galaxy from ZCAT.

unumber is either the UGC or ESO number of the source.

bt gives the total magnitude, as defined in the RC2, for those few galaxies that have them.

spectrum is an internal index for the optical spectrum, if one exists, of the galaxy in the CfA database.

comments are taken from ZCAT.

pF12, pF25, pF60, and pF100 are fluxes of the source as listed in the IRAS Point Source Catalog for those sources with ADDSCAN fluxes in columns 17-32; they are coded the same way as the earlier fluxes are.

There is a supplementary file, exclude.lis, which contains the numbers of the lune bins that are excluded (see Paper 1 for a full description). There is a series of Fortran programs in exclude.f that should be used to decide if a given object is in the excluded regions or not. First, run the program write_lmask, which reads the exclude.lis file and creates a binary file lmask.lis, which has much faster I/O. This only need be done once. Your code will need to call init_lmask to read in lmask.lis, and thereafter call the logical function exclude to decide if an object is in the excluded zones or not.

People may contact Michael Strauss at strauss@guinness.ias.edu if they have questions about these files.


```

1) INATES 000000720C TO EQUATORIAL AND ECLIPTIC CO-ORDINATES (IF IOPT=1)
2) JUST EQUATORIAL CO-ORDINATES (IF IOPT=2) OR TO 00000730C
3) 00000760C 00000750C ALL CO-ORDINATES ARE IN DEGREES.

4) 00000770C----- DATA RA2DEG5.72957795D17 00000790 # RADLON.RA
5) 780 DOUBLE PRECISION GLON,GLAT,GLON,GLAT,ELON,ELAT,RA2DEG, 00000800
6) DLAT,ZLON,ZLAT,ANGPOS,TANGSGN 00000810C 00000840 RADLO
7) RETURN 00000820 DATA RA2DEG5.72957795D17 00000840 RADLO
8) 00000830 N=GLON+RA2DEG 00000850 RADIAT=GLAT/RA2DEG
9) 00000840 CALL CEQFGA(RADLON,RADLAT,ZLON,ZLAT) 00000850 I
10) 00000850 CALL CEGKRN(RADLON,RADLAT,ZLON,ZLAT) 00000850 I
11) 00000860 CALL CEGKRN(GLON,RA2DEG*ANGPOS,ZLON) 00000850 I
12) 00000870 GLAT=RA2DEG*ANGSGN(GLAT) 00000850 I
13) F90GLON*GE*3.6D2*ZLON=0.0D0 00000870
14) 00000880 CALL Q2E(GLON,0LAT,ELON,ELAT) 00000880 I
15) 00000890 CALL Q2E(GLON,0LAT,ELON,ELAT) 00000890 I
16) 00000900 CALL Q2E(GLON,0LAT,ELON,ELAT) 00000900 I
17) 00000910 CALL Q2E(GLON,0LAT,ELON,ELAT) 00000910 IF(IOP1.EQ.1) RETURN
18) 00000920 CALL Q2E(GLON,0LAT,ELON,ELAT) 00000920
19) RETURN 00000930 CALL Q2E(GLON,0LAT,ELON,ELAT) 00000930
20) 00000940 CALL Q2E(GLON,0LAT,ELON,ELAT) 00000940 END
21) 00000950 CALL Q2E(GLON,0LAT,ELON,ELAT) 00000950
22) 00000960 SUBROUTINE P2BPN(ELON,ELAT,NBIN) 00000960
23) IMPLICIT DOUBLE PRECISION (A-H,P-Z) 00000960
24) CCC--Original Procedure modified to work in degrees instead of radians. 00000960CCC 00000960
25) DATA R2D/57.2957795/ DATA R2D/57.2957795/
26) 00001030 DATA MAXBIN 00001030 INTEGER MAXBIN(182)
27) 1040# 70,1,7,19,37,62,93,130,173,223,275,341,409,483,563, 00001050 # 650,743
28) *842,947,1F58,1175,1298,1427,1561,1711,1847,1999, 00001060 # 2156,2319,2488,2662,2841,3
29) 026,3216,3412,3613,3814,4050, 00001070 # 4246,4457,4693,4924,5160,5400,5645,5895,6149,
30) 640,667,1, 30001080# 6937,7208,7483,7762,8045,8332,8623,8917,9215,9516,9821,
31) 00001090# 10129,10444,01010754,11351,11719,12047,12358,12695, 0000110# 130
32) 32,13368,13706,14046,14388,14732,15078,15425,15774, 0000111# 16124,16476,16829,1718
33) 31758,17894,18231,18609,18967, 0000112# 19326,19685,20403,20763,21122,21481
34) *21840,22195, 0000113# 22557,22915,23272,23628,23983,24337,24650,25042,25392,
35) 0000114# 25088,26344,26778,27460,27798,28134,28467, 0000115# 
36) 28798,29126,29452,29775,30095,30412,30726,31037,31345, 0000116# 31650,31951,32249,
37) 32543,32834,33121,33404,33563,33958, 0000117# 34225,34496,34755,35017,35271,35521,3
38) 5766,36406,36242, 0000118# 36473,36699,36520,37136,37347,37553,37754,37950,38140,
39) 0000119# 38525,38505,38679,38848,39011,39168,39320,39466,39606, 0000120#
40) 39740,39869,39992,40109,40220,40325,40424,40517,40604, 0000121# 40684,40758,40
41) 82619568740544740594741074741107# 0000122# 41130,41148,41160,41166,41167#
42) 0000123# 1=90.0-ELAT* R2D+2.5 0000124# N=MAXBIN(I)
43) 0000125# MAXBIN(I-1) 0000126# N=MAXBIN(I)
44) 0000127# SIZE=360.0*REAL(N)
45) 0000128# J=ELON*R2D/SIZE+1 0000129# RETURN
46) 0000129# J=ELON*SIZE+1 0000130# END
47) 0000130# 0000133# 
48) 0000133# SUBROUTINE CEGETCCY,RA,DEC,LNG,LAT
49) 0000134# EQUATORIAL COORDINATES AT EPOCH Y TO ECLIPTIC COORDINATES 0000136# DO
50) 0000135# ECLIPSTION PRECISION T-RADIANT E3,E4,PBTZ# 0000137# UTR,T,E,EQP,PEQ,EQ,AN
51) 0000136# GSGN 0000138# 
52) 0000137# DATA E1,E2,E3,E472.3452294E1,-1.39125D-2,-1.E4U-6,5.03D-77# 00001410
53) 0000138# DATA PIBY2/1.570796326800/ 00001420 T=(Y-1900.0)/100.0
54) 0000139# 0000143# CALL SPTR1(RA+PIBY2,PIBY2-DEC,E,EQP,PEQ,EQ, 00001460
55) 0000140# T=PIBY2-PEQ, 0000144# DATE=PIBY2-EQ
56) 0000141# END 0000145# RETURN
57) 0000142# DATE=PIBY2-EQ
58) 0000143# END 0000146# RETURN
59) 0000144# END 0000147# RETURN
60) 0000145# END 0000148# RETURN
61) 0000146# END 0000149# RETURN
62) 0000150# END 0000151# RETURN

```

| RECORD COUNT CF TAPE CMW602 | | | | | | | | | |
|-----------------------------|--|--------|--------------|-------|------|------|--------|-------|--------|
| 3 | INPUT TAPE | CMW602 | ON | F-T1 | | | | | |
| 5 | FILE | INPUT | DATA RECORDS | MAX. | SIZE | PERM | ZERO B | SHORT | UNDEF. |
| 6 | RECS. | INPUT | | | | | | | |
| 7 | | | | | | | | | |
| 8 | | | | | | | | | |
| 9 | 1 | 1 | 1 | 22480 | 0 | 0 | 0 | 0 | 0 |
| 10 | 2 | 21 | 21 | 32736 | 0 | 0 | 0 | 0 | 0 |
| 11 | 3 | 1 | 1 | 16320 | 0 | 0 | 0 | 0 | 0 |
| 12 | 4 | 1 | 1 | 8790 | 0 | 0 | 0 | 0 | 0 |
| 13 | DOUBLE END OF FILE READ AFTER FILE | | | | | | | | |
| 14 | # OF PERMANENT READ ERRORS 0 | | | | | | | | |
| 15 | START TIME 05/12/92 02:12:13 STOP TIME 05/12/92 02:12:19 | | | | | | | | |
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